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BANK EROSION ALGORITHM FOR NUMERICAL MODELLING OF CHANNEL WIDTH ADJUSTMENTS

BY

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~~This report do~~cuments progress made since submission of the previous interim report, in July, 1994. Excellent progress has been made towards completion of this project. The previous interim report described how theoretical development of a new bank stability algorithm had been completed. Since that time, compilation of a data set suitable for validating the new model has been completed. The predictive ability of the new model has been tested using this data set. For comparative purposes, the data set has also been used to test the predictive abilities of the Lohnes and Handy (1968), Huang (1983) and Osman and Thorne (1988) bank stability analyses. Comparisons of predictive ability have been made both in terms of the factor of safety of the bank and the predicted incipient geometry of the failure blocks.

The results indicate that the new analysis is the superior analysis in terms of predicting overall stability with respect to mass failure (factor of safety), followed by the Osman-Thorne, Lohnes-Handy and Huang analyses. All the tested analyses over-predict factor of safety, indicating that the bank stability analyses tend to predict stable banks which, in reality, may be unstable. Analyses of the predictive abilities of the various analyses with respect to incipient failure block geometry show that factor of safety is over-predicted for the Osman-Thorne and Darby-Thorne analyses due to under-prediction of failure plane angle. Conversely, over-prediction of factor of safety in the Lohnes-Handy and Huang analyses appears to be due to under-prediction of failure block volume.

The results of the predictive comparison suggest that the new analysis developed in this research is likely to result in improved quantitative predictions of channel adjustments if implemented in the Darby-Thorne numerical model of river channel widening (Darby & Thorne, In Review). The existing Osman-Thorne algorithm in this numerical model obtains under-predictions of channel widening rates, the reason for which is now apparent from the results described above. Implementation of the new bank stability analysis in the Darby-Thorne numerical model is a topic of current research.

The new bank stability analysis has been developed as a computer program, which is fully supported by users manual documentation. The computer program is capable of predicting factor of safety or the probability of failure of a bank of geometry and geotechnical characteristics specified by the user. The user may also specify pore water pressure and confining pressure effects in the analysis of bank stability. In addition, the program may be used to compute the amounts of particle-by particle fluvial erosion and bed degradation required to destabilise an initially stable bank. This latter feature allows the new analysis to be used as a design aid in stable channel design applications where the degradation required to destabilise a bank is needed information. Examples include the positioning of grade control structure elevations in bank protection schemes, and estimation of impacts of fluvial erosion processes on land loss and bank sediment yields.

During a visit to the USA by the PI and RA in August 1994, extensive discussion held with staff at Colorado State University regarding the BURBANK computer model. Also, during a roadtrip later that month, the RA visited Vicksburg, Mobile and Huntingdon, as required under the project modification suggested by WES staff.

The computer program is now at an advanced stage in its development. Completion of the coding represents the final task to be accomplished in this project. A final draft report has already been written. It is expected that the final report will be submitted at the date scheduled for submission of the next interim report, 1 January 1995. This is well ahead of the June 1995 deadline for submission of the final report.